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Infrastructure Criteria for Fire Prevention and Response in Heritage Area Nyamplungan Village, Surabaya

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***Abstract*— Fire disaster is a serious disaster for urban areas. The establishment of Kelurahan Nyamplungan as Urban Heritage Area in Surabaya City, but for the last three years continue to experience a fire disaster. The fire incident in Kelurahan Nyamplungan is caused by the lack of existing fire fighting infrastructure performance. Fire prevention and prevention infrastructure is a system or physical facility for fire mitigation. Fire disaster that occurred in Kelurahan Nyamplungan this poses a threat for the indigenous people, business actors and tourists Urban Heritage Area. In the framework of fire disaster prevention, the need to analyze the criteria of disaster prevention and fire prevention infrastructure. The analysis method used in analyzing the criteria of fire prevention and prevention infrastructure in Kelurahan Nyamplungan is using descriptive analysis and delphi analysis. Based on the results of the research indicates that there are five criteria of infrastructure in the safe zone, seven infrastructure criteria in the medium zone, and nine infrastructure criteria in the vulnerable and highly vulnerable zones.**

Kata Kunci* : *Fire Prevention Infrastructure, fre disaster infrastructure criteria

I. INTRODUCTION

Fire disaster is a serious disaster for urban areas, this condition is due to the number of casualties and losses caused by the disaster [1]. Urban fire disaster can also be affected by urbanization, according to [2] urbanizers are the poor and most likely live in densely populated areas, coinciding with each other and standing on vague land status. The condition of the building of the house that coincide so vulnerable and prone to fire disaster [2].

Based on fire frequency data in Surabaya city, the frequency of fire that occurred in Kelurahan Nyamplungan in 2011 as much as 1 time, in the year 2013 as much as 4 times, and in the year 2014 as much as 2 times. Based on [3], fire frequency 1-2 times classification entry class low, frequency 3 times entering the classification of moderate, and more than 3 times entering high classification. The lack of infrastructure performance in disaster prevention and fire prevention and inadequate accessibility is the main cause of fire incident in Kelurahan Nyamplungan every year.

The establishment of Kelurahan Nyamplungan as one of the urban heritage area [4], then the need to do fire prevention efforts in the Heritage Area Village Nyamplungan. In order to carry out disaster prevention efforts, this research is focused to analyze the criteria of fire prevention and fire response infrastructure in Nyamplungan Village Heritage Area.

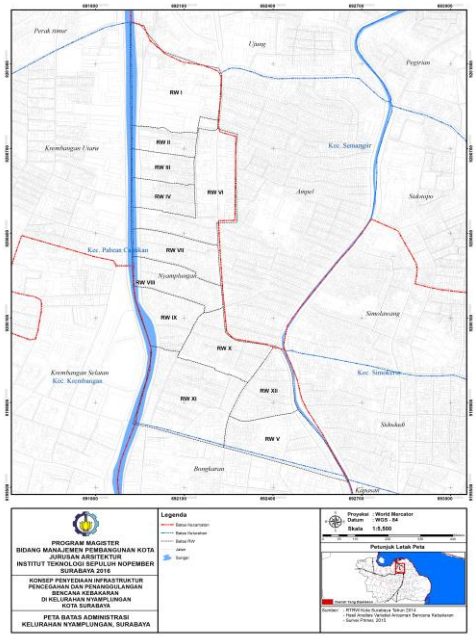

Fig. 1. Map of Study Area

II. LITERATURE REVIEW

A. Definition of Fire Disaster

Fire is an unexpected disaster and can cause material and non material loss. Urban fire disasters are caused by several aspects, including building characteristics, population density, natural environment, education level, household economy. This aspect has a strong relationship to the emergence of fire disasters. This is as revealed by Jennings (1996) that the characteristics of buildings made of wood and the characteristics of urban population can affect the occurrence of fire. In a study conducted by Gunther (1982)

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found that there is a correlation between climatic conditions and the magnitude of fire in the event of a housing fire. With colder climatic conditions, more people spend more time indoors which also increases the risk of fire from social activities, such as cooking. In addition, high temperatures outside the home due to the influence of global warming in urban areas can also increase the occurrence of fire.

B. Kampung Heritage

Cultural heritage area according to (Shirvani, 1985) is a region that once became the centers of a complexity of functions of economic, social, cultural activities that accumulate the meaning of the welfare (historical significance) and has a wealth of typology and morphology of urban heritage in the form of historical site, historical distric And historical cultural. The cultural heritage area may reflect the characteristics of a cultural city arrangement, possessing unique local characteristics characterized by found evidence of inscriptions that record events and the presence of sites, artifacts, historic buildings, palaces, keratins, churches, mosques, temples, Cities, markets and fields (square, park) and places that have character with a meaningful and positive environmental atmosphere for society (Rapoport, 1983) in (Juliarso, 2001).

C. Infrastructure of Fire Prevention

According to Stone (1974) the fire prevention and prevention infrastructure is a system or physical facility used to mitigate the occurrence of fires including fire suppression efforts, minimize efforts to prevent possible fire escalation, and evacuate people and save lives and property. Through the provision of adequate fire prevention and fire prevention infrastructure in urban areas, it will indirectly reduce the risk of fire.

Klinoff (2011) states that fire prevention and fire prevention infrastructure consists of firefighting posts serving as a gathering place for staff and firefighters; A fire truck that serves as a fleet of all equipment used to extinguish the fire; Building training facilities that serve as a training ground for firefighters such as rescue activities, victims evacuation, and fire suppression processes; Hydrants that serve as a storage place for water, otherwise having an inner hydrant at the training center will allow officers to practice using hydrants without worrying about disturbing traffic comfort and reducing water supply for outages; The library of fire-fighting providers is a complementary facility at the training center that allows firefighters, instructors and students to learn through books and videos of the fire-fighting process; Means of communication is a tool used by firefighters to receive emergency assistance calls and information related to the location of fires.

III. METHODOLOGY

This research includes qualitative descriptive research, because it is more to write what are the criteria of infrastructure that can be used for fire prevention and response in the heritage area of Kelurahan Nyamplungan. These infrastructure criteria are reinforced by the opinion of stakeholders in delphi analysis. Several methods of research analysis used are:

A. Stakeholder Analysis

Stakeholder analysis is conducted on the basis of importance and influence. Stakeholder analysis of this research to determine which parties will be involved in determining the criteria of fire prevention and fire response infrastructure in Kelurahan Nyamplungan. Stages in determining stakeholders :

1. Identifying relevant stakeholders
2. Analyzing the interets and the potensial impact of the existing problems of the respective stakeholders
3. Assessing the influence and significance of the respective stakeholders by weighting rangging from no effect to the highly influential/important with a scale of 1 to 5

From the analysis, five stakeholders deemed important and related to the study was selected.

- Head of Surabaya Fire Department
- Head of Kelurahan Nyamplungan
- Business Executors in Kelurahan Nyamplungan
- Lecture Department of Urban and Regional Planning, ITS Surabaya (Expert of Disaster)
- LPMK Kelurahan Nyamplungan

B. Identification of Infrastructure Criteria for Fire Prevention and Response in Heritage Area Nyamplungan Village

Theoritical Descriptive Analysis is a series of studies that can not be expressed in numbers and formulas but with words and sentences according to conclusion data (Sugiyono, 2006). Theoritical Descriptive Analysis is used to determine the relationship between the existing condition of infrastructure against disaster prone zones which then resulted in the criteria of disaster prevention and fire response infrastructure.

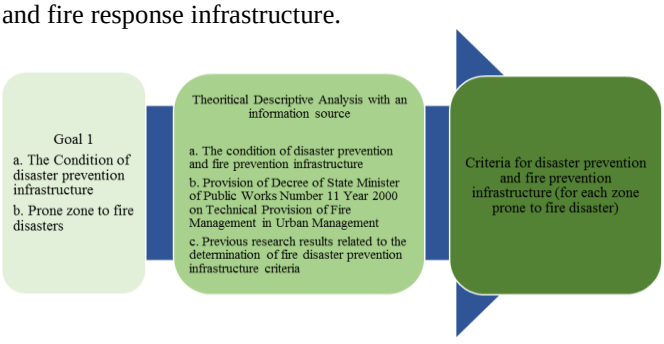

Fig. 2. Stage of Descriptive Analysis

C. Analysis of Infrastructure Criteria for Prevention and Response of Fire Disaster in Heritage Area Nyamplungan Village

Factors obtained from theoritical descriptive analysis, then validated with delphi analysis. Delphi analysis is an

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

attempt to obtain a continuous group consensus to obtain convergence of opinion (Dunn, 2003). Stages of delphi analysis in analyzing the criteria of fire prevention and fire response infrastructure in Nyamplungan Kelurahan Heritage Area are as follows:

1. Specification of problems and formulate questionnaire I, which is to determine the issue issues to be raised and commented by the respondents

2. Delphi Interview Round I

   Questions raised during the interviews derived from the infrastructure criteria for disaster prevention and fire prevention resulting from descriptive analysis

3. Analysis of Results of Round I

   Collecting data and verifying the respondents 'opinions then interpreting the respondents' opinion

4. Iteration and Withdrawal Conclusion

   At this iteration stage, the assessment of each respondent is collected and communicated back to all respondents so that the process of social learning and there is the possibility of changes in the initial assessment

IV. Analysis and Results

A. *Identification of Infrastructure Criteria for Fire prevention and Response in Heritage Area Nyamplungan Village*

Theoretical descriptive analysis in the identification of disaster prevention and fire response infrastructure criteria in the Nyamplungan Village Heritage Area aims to facilitate the selection of infrastructure criteria adapted to existing conditions and environmental characteristics. In conducting the analysis using descriptive analysis with theoretical descriptive by comparing theory related to fire disaster infrastructure, general policy / guideline. Fire disaster prevention and fire response in the Heritage Area of Nyamplungan Kelurahan is divided into 3 (three) fire-prone zones, ie safe zone, medium zone, and vulnerable zone-very prone to catastrophic disasters.

Based on the theoritical descriptive analysis above, the criteria of disaster prevention and fire prevention infrastructure for each zone of fire disaster in Kelurahan Nyamplungan are as follows:

1. Infrastructure Criteria for Fire Prevention and Fire Response in the Safe Zone

a. There should be a tool as the first outage step
b. There should be a suction pipe with a height of 1 meter and a diameter of 3/8 inch at least 2 point location to keep the water supply during fire fighting
c. There should be efforts to utilize Kalimati Wetan Street as an alternative evacuation route
d. There should be a marker tool that is placed in a location that is easily visible and easily accessible to the evacuation route
e. There should be open space as a gathering point with an evacuation plan

2. Infrastructure Criteria for Fire Prevention and Fire Response in Medium Zone

a. There should be an increase in fire range performance
b. There must be a smooth road assistance by pulling over and giving smooth acceleration of fire engine
c. There should be a construction of a water reservoir with a volume of 1800-2400 gallons (6800-9000 liters with a radius of 15 meters)
d. There should be an increase in the function of the command center 112 as a city fire alarm center that is directly connected to the fire station
e. There should be provision of class B and class C APARs that are effective in combating type and liquid fires of electrical appliances
f. There must be provision of a loudspeaker network equipped with a pre-amplifier to the environmental security post

3. Infrastructure Criteria for Fire Prevention and Fire Response in Prone and Very Hazardous Zones

a. There should be a distribution of firefighting post location especially in areas prone to fire
b. There should be a provision of environmental roads with pavement that is easy to pass by fire trucks that can be used maneuver and not dead end
c. There should be a fire-fighting development especially at the point of the zone prone and very prone to fire
d. There should be arrangements to apply ventilation to any buildings intended for evacuation access
e. There should be a marker tool that is placed in a location that is easily visible and easily accessible to the evacuation route
f. There should be the construction of an ultimate safety place protected from fire and smoke hazards
g. There shall be provision of hydrants with connection facilities for the Fire Department, namely fire brigade connection
h. There should be a special communication tool in the form of Handy Talky or Handphone provided specifically for communication with the Fire Department

B. *Analysis of Criteria of Infrastructure Criteria Prevention and Response of Fire Disaster in Heritage Area Nyamplungan Village*

In the descriptive analysis of the previous stage, infrastructure criteria have been produced based on each of the fire prone zones. Furthermore, the infrastructure criteria will be followed up to verify the results through interviews with stakeholders to get the criteria-criteria infrastructure consensus at each zone of fire disaster in Nyamplungan Village Heritage Area according to stakeholder agreement.

Exploration results (Delphi Phase I exploratory analysis interview) are as follows:

International Journal of Engineering Research & Technology (IJERT)
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Vol. 6 Issue 06, June - 2017

Table 1 : Compilation of the results of Delphi the analysis stage I

No	Kriteria	R1	R2	R3	R4	R5
Safe Zone						
1	There should be a tool as the first outage step	V	V	V	X	V
2	There should be a suction pipe with a height of 1 meter and a diameter of 3/8 inch at least 2 point location to keep the water supply during fire fighting	V	V	V	V	V
3	There should be efforts to utilize Kalimati Wetan Street as an alternative evacuation route	V	V	V	V	V
4	There should be a marker tool that is placed in a location that is easily visible and easily accessible to the evacuation route	V	V	V	V	V
5	There should be open space as a gathering point with an evacuation plan	V	V	V	V	V
Medium Zone						
6	There should be an increase in fire range performance	V	V	V	X	V
7	There must be a smooth road assistance by pulling over and giving smooth acceleration of fire engine	V	V	V	X	V
8	There should be a construction of a water reservoir with a volume of 1800-2400 gallons (6800-9000 liters with a radius of 15 meters)	V	V	V	V	V
9	There should be an increase in the function of the command center 112 as city fire alarm center that is directly connected to the fire station	V	V	V	V	V
10	There should be provision of class B and class C APARs that are effective in combating type and liquid fires of electrical appliances	V	V	V	V	V
11	There must be provision of a loudspeaker network equipped with a pre-amplifier to the environmental security post	V	V	V	V	V
Prone and Very Hazardous Zones						
12	There should be distribution of firefighting post location especially in areas prone to fire	V	V	V	X	V
13	There should be a provision of environmental roads with pavement that is easy to pass by fire trucks that can be used maneuver and not dead end	V	V	V	V	V
14	There should be a fire fighting development especially at the point of the zone prone and very prone to fire	V	V	V	V	V
15	There should be arrangements to apply ventilation to any buildings intended for evacuation access	V	V	V	V	V
16	There should be a marker tool that is placed in a location that is easily visible and easily accessible to the evacuation route	V	V	V	V	V
17	There should be the conctruction of an ultimate safety place protected from fire and smoke hazards	V	V	V	V	V
18	There shall be provision of hydrants with connection facilities for the Fire department is fire brigase connection	V	V	V	V	V
19	There should be a special communication tool in the form of Handy Talky or Handphone provided specifically for communication with the Fire Department	V	V	V	X	V

Source : Results of Delphi Interviews stage I, 2017

Information :
V : Agreed
X : Disagree*
*) If there are respondents disagree (X) then have not reached consensus and will be iterated
R : Respondent

The results of Delphi exploration phase 1, it is known that there are 5 (five) infrastructure criteria that have not reached consensus and 2 (two) new criteria from stakeholders. Furthermore, the results of Delphi exploration phase 1 used as a database for iteration stage (Delphi Stage 2) to reach a consensus. The infrastructure criteria that are based on the iteration stage are as follows:

Table 2 :
Database Criteria for Iteration Phase I Delphi Analysis

No	Kriteria	Keterangan
1	There should be a tool as the first outage step	Not Consensus
2	There should be an increase in fire range performance	
3	There must be a smooth road assistance by pulling over and giving smooth acceleration of fire engine	
4	There should be distribution of firefighting post location especially in areas prone to fire	
5	There should be a special communication tool in the form of Handy Talky or Handphone provided specifically for communication with the Fire Department	
6	There should be socialization to the community regarding the use of fire prevention and fire prevention infrastructure	New Criteria
7	There should be telecommunication tower provision to ensure communications in the event of a fire disaster or an emergency condition remains optimal	

Source : Results of Delphi Interviews stage I, 2017

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

Table 3 : Compilation of the results of Iteration (Delphi the analysis stage II)

No	Kriteria	R1	R2	R3	R4	R5
1	There should be a tool as the first outage step	V	V	V	V	V
2	There should be an increase in fire range performance	V	V	V	V	V
3	There must be a smooth road assistance by pulling over and giving smooth acceleration of fire engine	V	V	V	V	V
4	There should be distribution of firefighting post location especially in areas prone to fire	V	V	V	V	V
5	There should be a special communication tool in the form of Handy Talky or Handphone provided specifically for communication with the Fire Department	V	V	V	V	V
6	There should be socialization to the community regarding the use of fire prevention and fire prevention infrastructure	V	V	V	V	V
7	There should be telecommunication tower provision to ensure communications in the event of a fire disaster or an emergency condition remains optimal	X	X	X	X	X

Source : Results of Delphi Interviews stage II, 2017

Information :

V : Agreed

X : Disagree*

*) If there are respondents disagree (X) then have not reached consensus and will be iterated

R : Respondent

Based on the results of the Delphi exploration stage and the iteration stage (Delphi Phase II) above, it was found that the consensus criteria of fire prevention and fire prevention infrastructure in Nyamplungan Kelurahan Heritage Area are as follows :

1. *Infrastructure Criteria for Fire Prevention and Fire Response in the Safe Zone*
   a. There should be a tool as the first outage step
   b. There should be a suction pipe with a height of 1 meter and a diameter of 3/8 inch at least 2 point location to keep the water supply during fire fighting
   c. There should be efforts to utilize Kalimati Wetan Street as an alternative evacuation route
   d. There should be a marker tool that is placed in a location that is easily visible and easily accessible to the evacuation route
   e. There should be open space as a gathering point with an evacuation plan
2. *Infrastructure Criteria for Fire Prevention and Fire Response in Medium Zone*
   a. There should be an increase in fire range performance
   b. There must be a smooth road assistance by pulling over and giving smooth acceleration of fire engine
   c. There should be a construction of a water reservoir with a volume of 1800-2400 gallons (6800-9000 liters with a radius of 15 meters)
   d. There should be an increase in the function of the command center 112 as a city fire alarm center that is directly connected to the fire station
   e. There should be provision of class B and class C APARs that are effective in combating type and liquid fires of electrical appliances
   f. There must be provision of a loudspeaker network equipped with a pre-amplifier to the environmental security post
3. *Infrastructure Criteria for Fire Prevention and Fire Response in Prone and Very Hazardous Zones*
   a. There should be a distribution of firefighting post location especially in areas prone to fire
   b. There should be a provision of environmental roads with pavement that is easy to pass by fire trucks that can be used maneuver and not dead end
   c. There should be a fire-fighting development especially at the point of the zone prone and very prone to fire
   d. There should be arrangements to apply ventilation to any buildings intended for evacuation access
   e. There should be a marker tool that is placed in a location that is easily visible and easily accessible to the evacuation route
   f. There should be the construction of an ultimate safety place protected from fire and smoke hazards
   g. There shall be provision of hydrants with connection facilities for the Fire Department, namely fire brigade connection
   h. There should be a special communication tool in the form of Handy Talky or Handphone provided specifically for communication with the Fire Department
   i. There should be socialization to the community regarding the use of fire prevention and fire prevention infrastructure

V. CONCLUSION

The conclusion that can be drawn from this research is in the effort of prevention and prevention of fire disaster in Heritage Area Kelurahan Nyamplungan required criterion of fire prevention and fire prevention infrastructure in accordance with existing condition. The result of the research in the form of criteria of fire prevention and fire prevention infrastructure in Nyamplungan Kelurahan Heritage Area is the result of analysis and compiled based on fire disaster prone zones and in accordance with phases of fire disaster management pattern.

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